THE OPERATIVE TREATMENT OF CALCULI IMPACTED IN THE PELVIC PORTION OF THE URETER.

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THE operative treatment of stones impacted in the lower portion of the ureter has of late received a good deal of attention. During the last two years, I have operated on seven occasions at the London Hospital for the relief of this condition.

An investigation of the literature of the subject shows that the surgical treatment of impacted stone in the pelvic portion of the ureter is a comparatively recent achievement.

Fowler (in Annals of Surgery, 1904, XL. 943) gives a good account of the progress made in the operative treatment of these difficult cases. He states that Bardenheuer in 1882 was the first to remove a stone from the upper part of the ureter by the iliac extraperitoneal route. Even as late as 1898 the statement was made that stones impacted in the pelvic portion of the ureter were inaccessible to surgical treatment. Hurry Fenwick ("Obscure Diseases of Kidney," 1903, p. 151), however, removed a stone from the juxtavesical part of the right ureter by the perineal route in 1895. In 1892 Cabot (" International Journal of Medical Sciences," No. 103, p. 43) suggested that stones so placed could be removed by a modified Kraske operation, but the necessary severity of this procedure has condemned it as a routine method of treatment. Further Henry Morris (Surgical Diseases of Kidney and Ureter, 1901) showed that stones could be removed from this portion of the ureter in the female at any rate by a sacral route which did not involve any removal or division of the sacrum or coccyx.

Several recent writers have proved that stones impacted even in the portion of the ureter between the pelvic wall and the wall of the bladder can be removed by the inguinal extraperitoneal route. The difficulties of this operation however in a fat subject, and the fact that in the female the base of the broad ligament has to be encountered, are sufficient reasons for attempting some other means of access to this portion of the ureter. In certain cases where local removal is impracticable, stones can be displaced upwards owing to dilatation of the ureter above the site of impaction and they can then be removed by the inguinal route.

The extraction of a stone from the juxtavesical portion of the ureter has been carried out through the rectal wall on one occasion, the case was fatal and the operation is never likely to be repeated. A successful case of removal of a stone from the pelvic portion of the ureter by a transperitoneal operation is reported by Stewart,[5] but in the light of recent experience this route is no longer practised. An extraperitoneal operation is the method of election in all cases owing to the great risk of leakage and peritoneal infection by the transperitoneal route.

The writer of this article has exposed the ureter from below by a pararectal operation on four different occasions and has successfully removed stones in three of these cases. In the fourth the ureter was exposed and thoroughly explored with a bougie from the kidney to the bladder, but the stone had probably been passed.

Statistics of recorded cases show that the juxtavesical portion of the ureter or that portion between the pelvic wall and the bladder is a comparatively common site for impaction of a ureteral stone.

Henry Morris (loc. cit.) in 45 cases found: 19 within 2 inches of the bladder; 15 close to the vesical wall; 11 at the level of the brim of the true pelvis.

Schenck[6] in 1901 out of 84 cases, found that in 68 the site of impaction was stated as follows: 19 within 6 centimetres of the kidney; 8 at or near the brim of the pelvis; 41 within 2 inches of the vesical opening, *i.e.*, 50.6 per cent. of these cases were in this position.

Bovee[7] collected 64 operations in which an impacted calculus was removed by the extraperitoneal route.

In 57 of these cases: 22 were found at the upper constriction; 17 at the pelvic brim; 18 close to the bladder wall.

The operative treatment of stone impacted in the upper portions of the ureter need not be considered at length as on this point there is unanimity of opinion. The portion of the ureter extending from the pelvis of the kidney down to the point where it leaves the lateral wall of the pelvis can be exposed with comparative ease by the lumbo ilio inguinal incision. The peritoneum is raised up and the ureter which always adheres to this structure is defined. In the male subject if not too fat the portion of ureter between the pelvic wall and bladder can also be exposed. In a fat subject this may be very difficult and in the female impossible owing to the broad ligament. In all cases when possible the stone should be displaced upwards and removed high up. It is not always necessary to make the lumbar incision, an inguinal incision as for exposing the external iliac vessels need only be employed. Again there is little difference of opinion as to the methods of reaching stones impacted in the vesical orifice of the ureter or in the portion which traverses the bladder wall. The object of this communication is to especially discuss the operative treatment of stones impacted in the so-called juxtavesical portion of the ureter, that is, a portion about 3 inches in length which extends between the bladder wall and the ischium. More especially when the high route or inguinal extraperitoneal method is difficult or actually impracticable.

CASE I, in my series, illustrates a third condition which renders an inguinal operation impossible for stones impacted in this part of the ureter. In this patient a stone had already been removed by the inguinal route and another had formed in sitû, it was therefore impossible to again strip up the adherent peritoneum from the iliac fossa and brim of the pelvis.

The juxtavesical portion of the ureter is inaccessible from above in:

(1) A male subject with a fat abdominal wall.

(2) A female subject owing to the presence of the broad ligament.

(3) Cases where a stone has recurred in sitû after the inguinal operation.

The alternative operations which have been employed for exposing this portion of the ureter are:

(1) Transperitoneal. (2) Perineal. (3) Parasacral or pararectal without removal of bone (*i. e.*, the operation performed on these four cases). (4) Parasacral or pararectal with removal of a portion of the sacrum or coccyx. (5) Vesical (with dilatation of the vesical orifice of the ureter). (6) Rectal route. (7) Vaginal route.

The criticism already applied to the transperitoneal route, namely, risk of leakage, more than ever applies to removal of stone by this method from this part of the canal.

The perineal route must be very difficult and has peculiar risks attached to it. There is real danger of wounding the rectum, hæmorrhage is usually free, the vesiculæ and vas deferens may be damaged and it is quite impossible to apply sutures to the ureteral wall and difficult to insert bougies afterwards. Notwithstanding the brilliant result in Mr. Hurry Fenwick's case already mentioned this operation will probably never become a popular one.

In the female the vaginal route is the operation for choice when a stone can be easily felt by the examining finger. The risks are small and the danger of a subsequent fistula is not great. If the ureter is not adherent it may be easily pulled down by a blunt hook and sutures applied if thought necessary. The rectal route is rightly condemned and requires no further comment.

The vesical route is very difficult and the extraction of stones by dilating the vesical orifice of the ureter hardly feasible unless they be either very close to or impacted in the bladder wall.

There remains for discussion the so-called posterior or inferior routes of access to this portion of the ureter.

The principle in these operations is to reach the ureter from below by opening up the pararectal subperitoneal tissue.

Mr. Henry Morris (loc. cit.) has shown that this is possible in the female, and this paper deals with four similar operations performed on male subjects.

The ureter was reached with ease in three out of the four cases. In the fourth much difficulty was experienced for special reasons which will be mentioned presently. It was not found necessary to remove any portion of the sacrum or coccyx. The operative procedure employed is not in the least a new one but followed the teaching of Henry Morris and other authorities supplemented by practice on the dead subject. The description of the operation employed in these four cases is as follows:

The patient is placed on the side opposite to that on which the stone is impacted. The semiprone position is employed with the knees well flexed. The pelvis is raised by a small sand bag. The edge of the coccyx on the affected side is well defined by palpation with the fingers from outside. An incision 3½ inches in length is made, extending backwards from a point 2 inches from the posterior border of the anus. This incision is half an inch from and parallel with the edge of the coccyx, it passes upwards and outwards lying obliquely to the middle line of the body. The gluteus maximus muscle is exposed and its fibres completely divided for about two inches or more.

The great sacrosciatic ligament and the posterior portion of the ischio rectal fossa are thus exposed. The small and great sacrosciatic ligaments are next divided and the spine of the ischium must be clearly defined with the fingers. This bony point is the first important landmark in the operation.

The fibres of the coccygeus muscle and usually some of the posterior fibres of the levator ani come into view. The former are scratched through with a blunt dissector. The rectal fascia is next exposed and treated in the same manner. The subperitoneal space is then revealed, but the rectal wall itself is not defined.

The ureter is next sought for in the subperitoneal tissue. This is the most difficult part of the operation as the ureter remains closely connected to the peritoneum and is somewhat firmly embedded in the subperitoneal fat. It may also be surrounded by a plexus of vessels.

The position of the spine of the ischium is again noted and the ureter sought for lying about 3/4 inches above the spine in the axis of the operation wound. The best method of searching for the ureter is to use two pairs of long dissecting forceps. The peritoneum and subperitoneal tissue should be caught by the one pair and pulled up from the depths of the cavity. By fixing the peritoneum in this manner the dissection is made much easier. If this precaution is not observed the peritoneum is easily stripped off the lateral wall of the pelvis and tends to sag further and further towards the opposite side and deeper from the surface.

If difficulty is still experienced in finding the ureter and a stone cannot be palpated by a finger passed into the wound deep pressure should be made by an assistant on the abdominal wall in the pelvic region.

Further it is especially important to avoid needless stripping up of the peritoneum as this opens up a greater area of subperitoneal space which may later become septic.

If the ureter is still hidden a search forwards towards the base of the bladder will expose the apex of the vesical seminalis and having defined this the ureter will be found lying close to its inner border.

When the ureter is found and the stone located the latter is if possible displaced to another part of the canal. A longitudinal incision is then made and the stone extracted. A ureteric bougie is then passed down to the bladder and upwards to the kidney. This procedure is important as a stricture may also be present. The opening in the ureter is then closed by fine absorbent catgut sutures inserted after the Lembert principle, the mucous coat must on no account be penetrated by these sutures. A drainage tube is then passed down to the site of the incision. The sacrosciatic ligaments are then sutured with chromic catgut, then the fibres of the gluteus maximus and finally the skin wound leaving an opening at one end for the tube. The opening in the ureter need not necessarily be sutured but in my cases the sutures were inserted without any difficulty.

THE AFTER EFFECTS OF THE OPERATION.

In each of these four cases some leakage of urine took place from the wound for a few days. With one exception the wounds healed rapidly and the tube sinus quickly closed.

In Case 4 some fresh leakage occurred later and the sinus reopened and discharged pus, but the dependent position of the track allowed natural drainage and checked any tendency to extension of suppuration.

The result of division of this small portion of the gluteus maximus was insignificant, some wasting of the posterior part of the muscle could be seen but in two of the patients, observed 12 months after the operation, no appreciable loss of muscular power was experienced.

The advantages of this operation:

(a) The abdominal wall is not incised and therefore the risk of a ventral hernia is absent.

(b) The ureter is directly approached from below and the great disadvantage of stripping up the peritoneum and opening up the retroperitoneal space is avoided.

(c) The hæmorrhage in this operation should be trifling as no vessels of any size are encountered.

(d) There is no risk of damage to the iliac vessels either by carelessly stripping up the peritoneum or later by the presence of the drainage tube.

(e) The position of the wound ensures perfect drainage in the recumbent position.

(f) In the inguinal operations this portion of the ureter lies at a greater depth from the skin surface especially in a fat subject. The actual depth from the surface at which the ureter lay in one of my patients was by measurement 3½ inches.

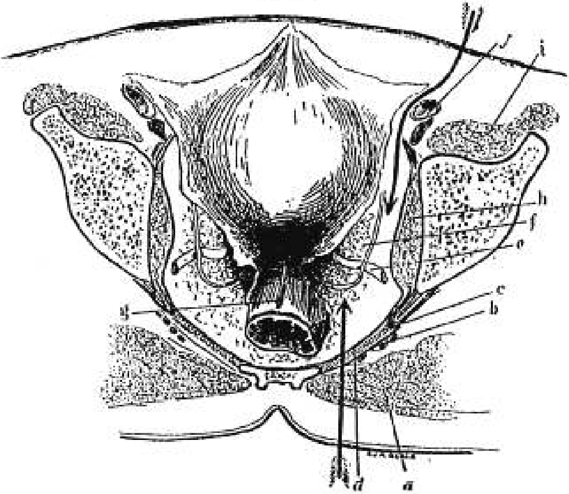
(g) The ureter can be pulled up within easy reach so that sutures can be introduced accurately without any difficulty.

If the stone cannot be felt there may be great difficulty in defining the ureter. In Case No. 3 where a small stone was fixed in the paraischial portion the ureter could not be defined until a transperitoneal exploration was also made. In Case

No. 4 on the other hand the ureter was easily found, although no stone was present. In Cases 1 and 2 no difficulty was experienced.

Figure 1 is a section made from a frozen pelvis. The section was made through the lower portion of the coccyx posteriorly and just above the pubes anteriorly.

FIGURE I.



a, Gluteus maximus; *b*, sacrosciatic ligaments; *c*, coccygeus muscle; *d*, rectal fascia; *e*, ureter; *f*, vas deferens; *g*, rectum; *h*, obturator externus; *i*, iliacus; *j*, ext. iliac vessels.

This section includes the tissues involved in both the inguinal and pararectal operations. The arrows show the paths taken in exposing the ureter by these two routes.

Figure 2.—This is a drawing made from a longitudinal section of the female pelvis by Mr. Arthur Keith. The specimen is in the Museum at the London Hospital Medical College.

The cervix uteri has been removed so as to expose the path of the ureter beneath the broad ligament.

The following is an abstract of the Cases on which this communication is based:

CASE I.—E.B., aged 21 was admitted into the London Hospital on January 6th, 1905. He gave a history extending over a period of two years of recurring attacks of right renal colic. He had never noticed any alteration in the urine.

A radiograph was taken and showed a distinct shadow in the right kidney just below the last rib.

On January 13th, 1905, a stone composed of uric acid and phosphates was removed from the cortex of the right kidney. A bougie was passed down the ureter into the bladder without encountering any obstacle. The wound was partially closed and an uneventful recovery followed. He left the Hospital on February 9th, 1905.

On August 21st, 1905, he was re-admitted with the following symptoms. Pain in the glans penis during the act of micturition. This commenced about 3 months after leaving the Hospital, and has continued on and off up to the present time. When the pain is severe he has increased frequency of micturition both during the night and day. He has never noticed any hæmaturia. In addition to the penile pain he has had aching in the right loin in the site of the scar.

On admission. The scar looked quite healthy. The right kidney could not be felt and was not tender even on deep palpation. There was no tenderness along the course of the ureter. A rectal examination revealed a tender point at the base of the bladder on the right side but a calculus could not be felt. A radiograph was taken and a distinct shadow could be seen in the right ureter apparently just above the right ischial spine. The urine was acid contained pus corpuscles, a small trace of albumen, no blood, no casts. The amount of urine passed per diem was 18 to 22 ounces.

On August 26th, 1905. An incision was made above and parallel with Poupart's ligament on the right side. The muscles of the abdominal wall were divided and the peritoneum stripped up from the right iliac fossa. The ureter was exposed and followed down as far as possible but the stone could not be felt. A small opening was made in the ureter and a probe was passed down. This was stopped apparently just outside the bladder wall.

A finger was then inserted into the rectum and the base of the bladder and lower end of the ureter pushed upwards. A small stone could then be easily felt. The ureter was traced further downwards after some difficulty and an attempt was made to displace the stone upwards but without success. An incision was then made over the impacted stone and it was extracted. The two openings made in the ureter were closed by fine silk sutures including the serous muscular coats only. The lower opening was closed after very great difficulty. A drainage tube was left in sitû and the wound partially closed. A discharge of urine took place from the tube for a week. The tube was removed on September 4th and the patient left the Hospital well on September 23rd, 1905.

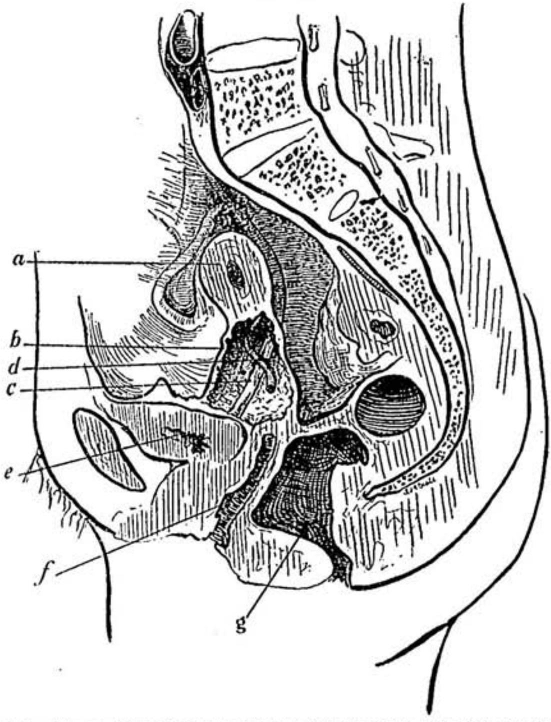
On February 23rd, 1906, the patient was re-admitted into the Hospital with recurrence of similar symptoms, namely, severe penile pain during micturition, slight increased frequency but no bleeding. The urine was found to contain albumen and pus in small quantities. A radiograph again showed a calculus in the right ureter apparently in the same position as the previous one.

On March 9th, 1906, a transperitoneal operation was made to try and shift the stone upwards from the pelvis to the upper part of the ureter. The patient was placed in the high Trendelenberg position and the attempt was made through an incision in the right semilunar line. The stone, however, was firmly fixed and could not be shifted at all. An endeavor to restrip the peritoneum from the right iliac fossa proved futile as it was firmly bound down by adhesions from the previous operation. The abdominal wound was therefore closed and the patient sent back to bed.

On March 16th, 1906, the patient was again anæsthetized and the stone was removed by a pararectal operation as described above. There was little difficulty in the operation, the stone was found and the ureteral incision sutured with fine catgut sutures. The depth of the ureter from the surface in this case was measured and found to be 3½ inches. A drainage tube was left in and the wound and muscles partially closed by sutures.

There was leakage of urine for 48 hours from the wound but never in any large amount. The wound healed well and the patient left the Hospital on April 13th. The calculus which was removed was composed of phosphates and in its centre was found a small silk suture evidently one of those introduced at the last operation. Since this date the patient has passed two small phosphatic stones via the urethra after more or less severe attacks of colic. Each of these stones contained small silk sutures. The last of these was passed on February 5th, 1907.

FIGURE II.



a, body of uterus; *b*, broad ligament; *c*, ureter; *d*, uterine artery; *e*, bladder; *f*, vagina *g*, rectum.

CASE II.—F.P., aged 10, was admitted into the Poplar Hospital on May 15th, 1906. For three months he had complained of recurring attacks of pain in the right loin and right side of the abdomen. The attacks were severe and accompanied by hæmaturia. There was no pain in the penis but the pain during the height of the attacks radiated to the bladder, right groin and testicle.

A radiograph showed a well marked shadow in the region of the right kidney and another close to the bladder in the right ureter. The bladder had been sounded with a negative result. A stone could not be felt on rectal examination.

On May 26th, 1906, a stone was removed from the right ureter by a pararectal operation. The ureter was easily found as the stone could be felt in the bottom of the wound. The stone was extracted and the urethral opening sutured with fine catgut.

An incision was next made in the right lumbar region and a stone removed from the pelvis of the right kidney. The two operations took 45 minutes. There was a little leakage as usual from the pararectal incision for about five days. The two wounds healed well and the patient left the Hospital on June 24th.

Fig. 3 is a photograph taken three months after the operation. (Fig. 3.)

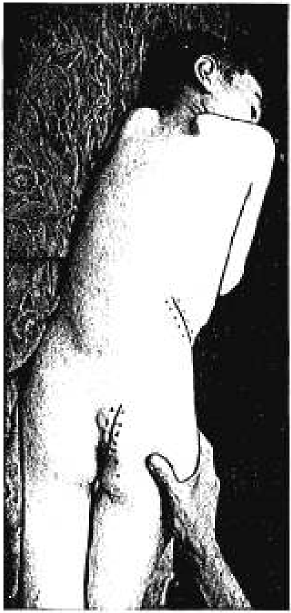
Case III.—F.J., aged 35, was admitted into the London Hospital on January 16th, 1907. He complained of recurring attacks of severe colic on the right side. The first attack was in August, 1906. The attacks lasted from 3 to 5 days. He was quite free from pain in the intervals. On one occasion the pain radiated to the right testicle. He never had pain in the glans penis. Blood was never noticed in the urine and there was no frequency of micturition.

On October 10th an examination of the abdomen and by the rectum revealed nothing abnormal. The urine was normal. A radiograph was taken and a distinct shadow could be seen just below the pelvic brim on the right side. He was recommended to take large quantities of fluid in the hope that the stone would pass into the bladder.

On November 10th a second radiograph was taken. During this interval he had one further attack of severe colic. This radiograph appeared to show that the stone had become displaced downwards and was now lying just above the ischial spine.

He persevered with the palliative treatment and between this date and January 4th, 1907, he had four further attacks of colic. He had no increased frequency, hæmaturian or penile pain.

FIG. 3.



CASE II.—Photograph of scar left after the pararectal operation.

A third radiograph taken January 10th showed that the stone was in the same position. Operation was advised and performed on January 19th, 1907. The pararectal route was adopted as the stone was thought to be lodged in the juxta vesical part of the ureter. The pararectal space was opened up but the ureter could not be defined and no stone was felt. After a prolonged search a small incision was made in the right semilunar line and two fingers were inserted into the peritoneal cavity. The ureter was then palpated with two fingers in the pelvic cavity and one in the pararectal space. The ureter could thus be easily defined although no stone was felt, on tracing the ureter upwards a very small stone could be felt lying against the lateral wall of the pelvis above the ischial spine. The ureter was next defined from the pararectal wound assisted by the fingers in the abdominal cavity. A small incision was made in its wall and a probe passed upwards for 1½ inch struck against the stone. A pair of urethral forceps were next inserted and pushed up the ureter and after several attempts a small rough oxalate stone was grasped and easily extracted.

The incision in the ureter was closed as before with fine catgut. The small incision in the right semilunar line was next closed and the parasacral incision partially closed. The after progress of this case was prolonged owing to late thrombosis occurring in the left femoral vein. The wound by the coccyx leaked urine for four days, then healed up slowly.

On February 10th signs of thrombosis developed in the left femoral vein and on February 27th patient suddenly developed symptoms of pulmonary embolism. This he recovered from but the thrombosis of the leg persisted.

On March 4th a fresh collection of pus developed in the track of the drainage tube in the parasacral wound. This was evacuated and after a few days the wound again closed. Further progress was uneventful.

The difficulties experienced in this case were entirely due to a wrong appreciation of the position of the calculus. It would certainly have been wiser to have approached the ureter in this case by the inguinal route. The patient was a stout muscular man and this added considerably to the depth of the ureter from the surface.

CASE IV.—W.M., aged 54, was admitted into the London

Hospital on August 4th, 1906. She complained of being ill for 5 or 6 years but much worse for the last 6 months. The chief symptoms are pain in the left loin radiating down to the hypogastrium and scalding pain in the urethra during micturition. There is much increase in frequency and blood was noticed in the urine on one occasion. An abdominal examination was negative. On vaginal examination a hard substance could be easily felt in the left fornix apparently close to the cervix uteri.

A radiograph showed two definite shadows in the region of the left kidney and a rather large elongated shadow in the pelvis apparently in the lower portion of the left ureter.

On August 13th, 1906, an anæsthetic was given and vaginal examination again revealed the presence of a stone in the lateral fornix. The bladder was cystoscoped. The left urethral orifice appeared to be somewhat dilated.

An incision was then made to the left of the cervix uteri through the vaginal wall. A stone was reached easily; it was firmly impacted in the ureter and during extraction was broken up into 3 pieces. A vaginal douche was given and dressings applied. A small gauze drain was inserted down to the ureteral incision. The patient was then turned on her right side and the left kidney exposed by the usual lumbar incision. The kidney was found considerably atrophied. At the lower part in the cortex were found two white cheesy masses embedded in smooth walled cavities, these were evacuated. Below these and deeper in the kidney substance was found a very friable calculus about the size of a small marble. This was removed. The cavities in the kidney were drained with gauze and a drainage tube passed down to the cortex. The lumbar wound was then partially closed.

After progress. The wound in the vagina apparently healed quickly as no urine escaped at all. The lumbar wound healed rapidly and no urine escaped. All the symptoms were relieved by this operation. The patient left the Hospital on September 4th, 1906.

Second operation. This patient was again admitted into the Hospital on April 2nd, 1907. Two months after leaving the Hospital the old pains returned again. She had severe burning pains like needle pricks on micturition. The pain was chiefly in the meatus and urethra. She also complained of pain in both loins and in the hypogastrium. She had frequency every half hour night and day. No blood was noticed.

A vaginal examination revealed the presence of another stone in the same position as before and a radiograph corroborated this, two well marked elongated shadows could be seen. The kidney region showed nothing abnormal. Abdominal examination was negative.

On April 5th, 1907, the patient was operated upon a second time as follows: An incision was made in the left lumbar region along the side of the old scar. The kidney was exposed. It was adherent but was freed and removed without difficulty. The organ was very small and the vessels atrophied. No calculus was found.

The patient was next placed in the lithotomy position. An opening was made in the vaginal wall as before and two phosphatic stones removed from the left ureter. A probe was passed up the ureter. A vaginal douche was given and perineal dressings applied. No drain was used.

The after progress of this case was uneventful and the symptoms were again entirely relieved by the operation.

In this case it would probably have been better to have removed the kidney at the first operation and so avoided the fresh formation of stones.

CASE V.—S.L., aged 22, admitted into the London Hospital on February 14th, 1907.

History.—In July 1906 a stone was removed from the upper part of the left ureter at University College Hospital. In November 9th, 1906, he was admitted into the London Hospital and a stone was removed from the paraischial portion of the right ureter by the inguinal route. The wound drained insufficiently and leakage of urine was followed by spreading suppuration in the subperitoneal tissue. On December 17th, 1906, an abscess was opened in the right flank which had tracked up along the abdominal wall.

The patient left the Hospital soon after with wounds healed. The present symptoms commenced in January, 1907, in the left lumbar region aching in character sometimes radiating down along the course of the left ureter and involving the left testicle. The pain was always present but sharp exacerbations occurred two or three times a week. There was also pain in the glans penis after micturition. There was no hæmaturia. The urine contained a trace of albumen and some pus.

A radiograph showed an indistinct shadow apparently due to a stone in the juxavesical portion of the left ureter.

On February 22nd, 1907, the pelvic portion of the left ureter was explored by the pararectal route. The ureter was found easily. It did not appear to be abnormal. A small longitudinal incision was made in its wall and a ureteric bougie passed down to the bladder and up to the pelvis of the left kidney. A stone could not be felt.

The ureter was then hooked up and two catgut sutures were inserted to close the wound. A small tube was left in sitû and the muscles and skin united. Slight leakage of urine was noticed for two days. The tube was removed altogether on March 1st, that is 7 days after the operation and the wound healed rapidly. The patient left Hospital with complete relief of his symptoms.

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